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DERWENT-WEEK: 197948

TITLE: Cylinder bore reducing assembly - is inserted from cylinder head end and has shoulder seating on ledge around top of cylinder to prevent excessive insertion

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ABSTRACTED-PUB-NO: GB 2021236A

BASIC-ABSTRACT:

The **liner** enables the bore of the **cylinder to be reduced to a size smaller than that of the connecting rod** big end even where connecting rod can only be inserted from cylinder head end.

The **liner** (1) is held in position by shoulder (4) engaging ledge (6) and by the cylinder head located down onto the top of the block (2). Rotation of the **liner** is prevented by a keyway (7) formed in the block (2) and the **liner** in which a locating pin is seated. Shims (6) may be provided between ledge (6) and the **liner** shoulder (4).

TITLE-TERMS: CYLINDER BORE REDUCE ASSEMBLE INSERT CYLINDER HEAD END SHOULDER
SEAT LEDGE TOP CYLINDER PREVENT EXCESS INSERT

DERWENT-CLASS: Q52 Q65

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GB 1535043
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GB 947981
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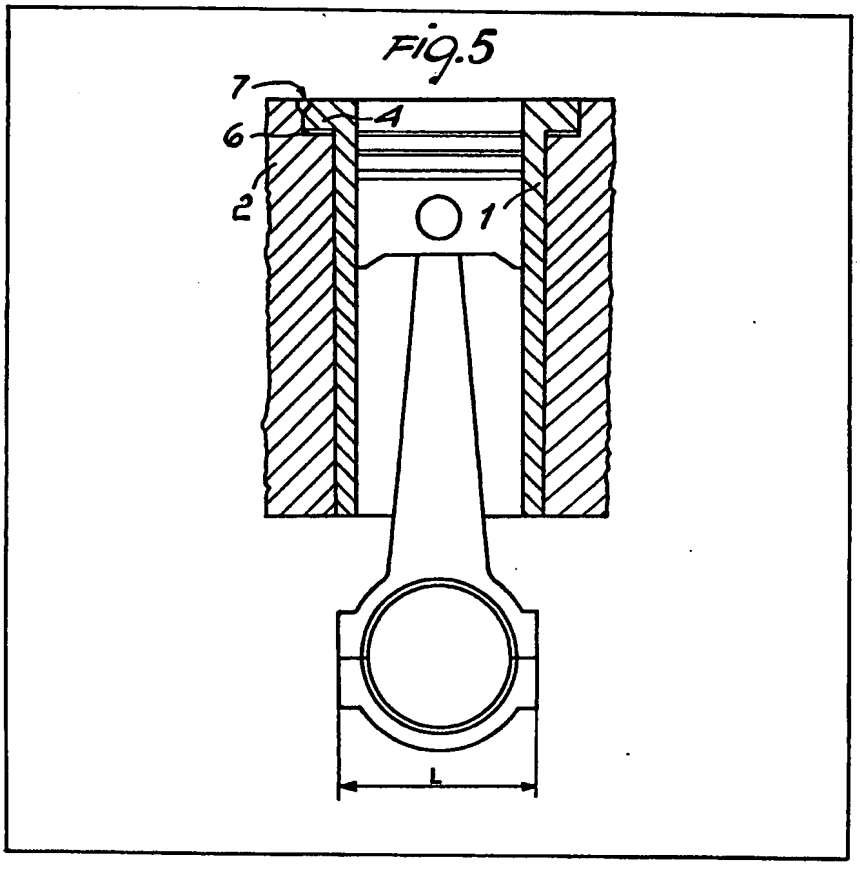
(54) **Cylinder liners**

(57) A cylinder bore diameter reducing assembly comprises a cylindrical liner (1) adapted for insertion into an engine cylinder (2) from the head end thereof, the undersize piston being prepositioned in the liner (1). Between the liner (1) and cylinder (2) there are provided an abutment (4) to prevent the liner from sliding towards the engine crankshaft and a keyway (7) for a locating pin effective to prevent the liner (1) from rotating with respect to the cylinder (2).



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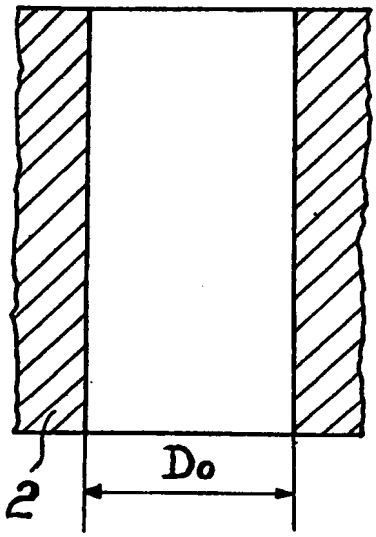


Fig.1

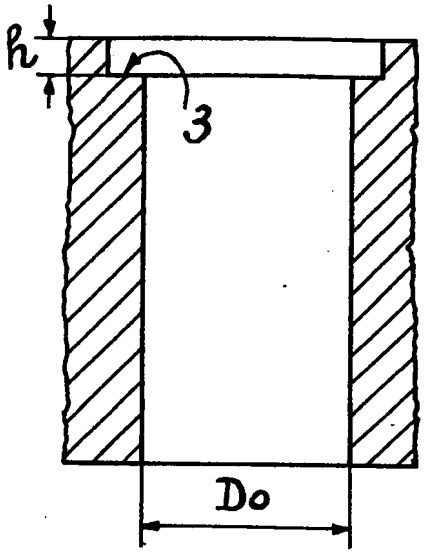


Fig.2

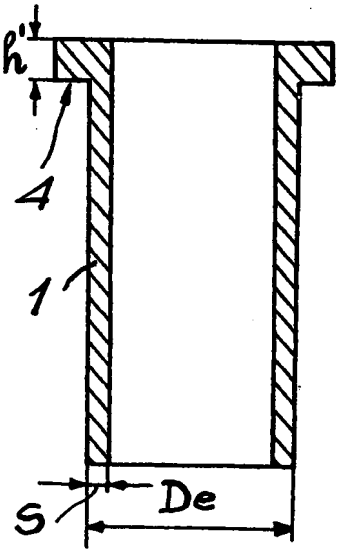
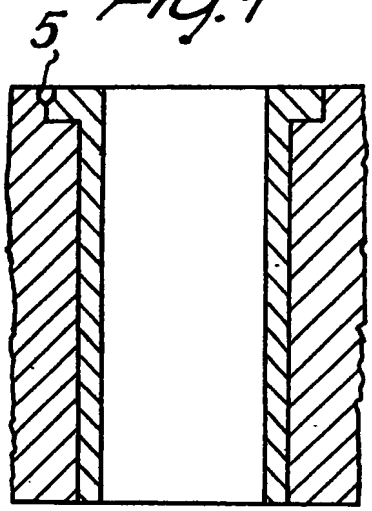


Fig.3



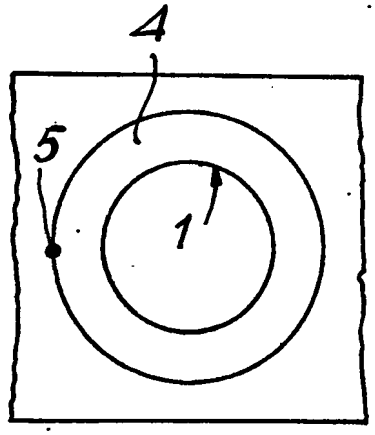


Fig.4

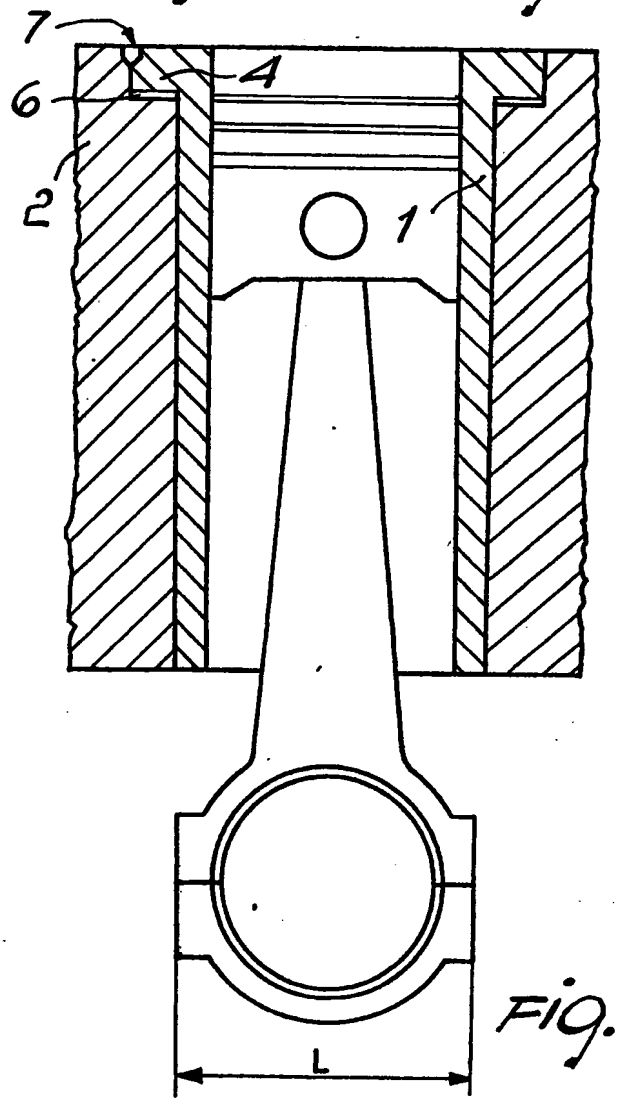


Fig.5

SPECIFICATION

Cylinder bore diameter reducing assembly

This invention relates to a cylinder bore diameter reducing assembly for internal combustion engines, steam engines, piston pumps, and similar machines.

As is well known, the swept volume or displacement of an engine is calculated as the product of one piston surface area times the piston stroke length times the number of cylinders, thereby for a given piston stroke length and number of cylinders, an engine displacement can only be reduced by having a smaller piston or cylinder bore diameter. Also known is that owing to the general trend for increasingly more compact engine designs, the piston-conrod assembly can only be inserted into its cylinder from the cylinder head end, it being impossible to do so from the crankshaft end of the cylinder.

Since in actual practice and most cases the width *L* of the connecting rod big end is nearly equal to or only slightly smaller than the piston diameter, whenever a standard dry replacement of the cylinder liner is carried out in order to reduce the piston or cylinder diameter, it is often found that the conrod cannot be inserted therethrough.

In view of the above situation, it will be apparent that to reduce the piston diameter, the piston must retain a larger diameter than the width dimension of the conrod big end, or in other words, only a very small bore diameter reduction is feasable due to the requirement that it should at all times exceed the overall width of the big end of the connecting rod.

This is obviously inconvenient, inasmuch as the range within which the piston or cylinder size may be altered is quite small.

This invention is directed to providing a cylinder bore diameter reducer, which allows the utilization of a piston having a smaller diameter than the width of its conrod big end, such as to afford almost any desired extent of cylinder displacement reduction.

Within that general aim, it is possible to arrange for the invention to provide a reducer as indicated, which is extremely practical in use, simple, easily manufactured, effective and reliable in operation, and of camparatively low cost.

According to one aspect of the present invention, there is provided a cylinder bore diameter reducing assembly characterized in that it comprises a cylindrical liner adapted for insertion into an engine cylinder from the cylinder head end therof after the cylinder head has been removed, the undersize piston being pre-positioned in said liner; and in that between said liner and cylinder an abutment shoulder means is provided to prevent said liner from sliding down towards the engine crankshaft, any liner movement in the opposite direction being prevented by the cylinder head, as well as a keyway for a locating pin effective to prevent said liner from rotating with respect to the cylinder.

Further features and advantages will be more clearly understood from a detailed description of a preferred but not limitative embodiment of a cylinder bore diameter reducer according to the invention, illustrated by way of example only in the accompanying drawing, where:

Figure 1 is a sectional view through an engine cylinder;

Figure 2 is a sectional view through an engine cylinder ready for receiving the reducing liner therein;

Figure 3 is a sectional view through the reducing liner;

Figure 4 is a sectional view through the reducing liner as installed in an engine cylinder with a locating pin against rotation; and

Figure 5 is an elevational view of an engine cylinder with the reducer and piston-conrod assembly installed.

With reference to the drawing figures, the cylinder bore diameter reducer according to this invention comprises a cylindrical liner 1 (Figure 3) having its outside diameter *DI* smaller than the diameter *Do* of the original engine cylinder bore 2 by an amount such that said liner can be inserted by hand to a slightly tight fit. The top portion of the cylinder is formed with a wider diameter portion 3 adapted for receiving an abutment shoulder 4 provided at the liner top, which abutment shoulder has the function of preventing any sliding movement of the liner after the cylinder head has been installed and comprises an annular rib.

Shims 6 may be inserted, if necessary, under the abutment shoulder 4, in the widened portion 3.

A locating pin 5, inserted in a keyway 7 between the liner and cylinder, prevents the line from rotating or turning in the cylinder.

It should be noted that this reducer differs from the conventional liners currently mounted by engine manufacturers in that conventional liners are dry fitted in accordance with the relation:

$$De=Do+0.0X \text{ mm}$$

thereby, after the liner with the piston-conrod assembly mounted therein has been inserted, in order to disassemble it or pull out the piston-conrod assembly, the liner itself must be broken, whereas with the reducer according to this invention, the piston-conrod assembly can be removed effortlessly and without using any specific tool, the liner being reusable and the whole operation being performed with the engine still mounted to the vehicle.

The installation of the reducer according to this invention is carried out as follows.

Starting with the cylinder in its original configuration, the top portion — or region 3 — thereof is widened to form a seat for the abutment shoulder 4; it should be noted that the height *h* of the abutment shoulder 4 can occupy the liner top region, as shown in the drawing, or extend down to the middle thereof, or nearly to the liner base, or even over the full length of the liner.

The liner is prepared by first checking that its

outside diameter *De* is smaller than the cylinder diameter *Do* by a sufficient amount to ensure insertion ability by hand to a slightly tight fit without any successive tolerance De=Do — 0.0X mm.

As concerns the inside diameter of the liner, this will depend on the diameter of the piston to be installed. The value *h*1 of the liner shall have to be smaller than the value *h* of the cylinder, and this to meet machining requirements.

Surface levelling of the cylinder top flush with the reducer top is obtained by means of shims 6 of various thicknesses. Then, a hole 7 is drilled to form a keyway for the locating pin 5. Next, the amount of shims required is calculated, and the liner is removed to permit shimming up as indicated, Thereafter, the connecting rod together with the piston and piston rings are inserted through the liner, and the whole is introduced into the cylinder cavity. Finally, the conrod is assembled to the crankshaft, followed by the cylinder head, or viceversa, to complete the installation procedure.

As regards the thickness S of the reducer, this is determined in accordance with the engine design and characteristics. In the event that it is too thin, it will be sufficient to increase in proportion *Do* as the cylinder is rebored to form the widened area 3.

If the bore diameter reduction is excessive, it may happen that the valves can no longer open because they strike the liner top surface. In this case, it will be necessary to either remove material from the liner interior to allow for the valve opening movement, or if advisable, to reduce the valve diameters, for there exists a relationship between piston displacement and valve diameter.

It should be further noted that with the reducer according to this invention, in addition to the piston displacement reducing procedure proper, also facilitated are overhaul, repair (in the event of piston binding or freezing, piston ring breaking, scored liner, etc.) and other operations; in fact, such operations are easily effected by simply disassembling the cylinder head and crankcase cover, and withdrawing the liner from the top, along with the piston-conrod assembly therein.

Thus, the invention achieves its objects, and in particular it has been shown how the cylinder bore diameter can be reduced in an engine wherein the outline dimension of the conrod big end is substantially equal to the cylinder cross configuration.

The invention as described is susceptible to many modifications and variations, all of which are intended to fall within the scope of the instant inventive concept. Furthermore, all of the details may be replaced with other technically equivalent ones.

In practicing the invention, the materials employed, as well as the shapes and dimensions, may be any ones, to suit individual requirements, without departing from the broadest scope of the appended claims.

CLAIMS

1. A cylinder bore diameter reducing assembly, characterized in that it comprises a cylindrical liner adapted for insertion into an engine cylinder from the cylinder head end thereof after the cylinder head has been removed, the undersize piston being pre-positioned in said liner; and in that between said liner and cylinder an abutment shoulder means is provided to prevent said liner from sliding down towards the engine crankshaft, any liner movement in the opposite direction being prevented by the cylinder head, as well as a keyway for a locating pin effective to prevent said liner from rotating with respect to the cylinder.

2. A diameter reducer according to Claim 1, characterized in that said abutment shoulder comprises an annular rib on the liner outside, said annular rib being adapted for fitting into a mating widened portion in the cylinder.

3. A cylinder bore diameter reducer substantially as herein described with reference to the accompanying drawings.

4. Any novel element, or combination of elements, herein described and/or shown in the accompanying drawings, irrespective of whether the present claim is within the scope of, or relates to the same invention as, any of the preceding claims.

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